IN THE SPECIFICATION

Please amend paragraph [0004] as follows:

[0004] The increase in the number of adsorbent vessels and valves in PSA systems undesirably increases manufacturing and operational costs. Many innovative cycles have been proposed that economize the number of beds and/or valves employed in PSA systems. An excellent example ~~is~~ of such a system is described in U.S. Patent No. 3,738,087 to McCombs, as well as a later process described in U.S. Patent No. 4,194,890 to McCombs. These patents describe PSA systems with as few as two adsorbent vessels; however, continual delivery of product is usually impossible or can be achieved only at a reduced product pressure. Furthermore, these sorts of cycles are generally understood to offer lower product gas recovery and adsorbent utilization at a given set of feed conditions. Efforts to produce more complex cycles with fewer valves, or at least simpler plumbing arrangements than that of Wagner, Batta, and Fuderer et al. while maintaining their high performance have been revealed in U.S. Patent No. 4,761,165 to Stöcker and in U.S. Patent No. 6,146,450 to Duhayer et al.

Please amend paragraph [0005] as follows:

[0005] Several PSA systems have been presented that reduce mechanical complexity through the implementation of rotary valving arrangements by combining many valve functions from earlier processes to reduce complexity. Examples of such systems include U.S. Patent No. 4,272,265 to ~~Sayder~~ Snyder, U.S. Patent No. 4,925,464 to Rabenau et al., and U.S. Patent No. 6,063,161 to Keefer et al. In each case the use of one or more

rotating assemblies with valving functionalities are employed in place of one or more independent valves. Although these methods advantageously reduce the plumbing complexity compared to independent valves plumbed in a traditional manner, they have several undesirable features. First, they fix the relative duration of the various PSA cycle steps, and are thus unable to respond to changes in flow conditions to optimize operation with variability in feedstock composition, temperature, pressure or flowrate. Keefer et al. describe the addition of special secondary ~~vales~~ valves to their basic rotary valves in order to fine tune the PSA cycle, which undesirably increase complexity and are not adjustable during operation. Second, all rotating valves rely on sliding sealing surfaces to separate purified product from impure feed or waste gases. Indeed, Keefer et al. teach elaborate mechanical steps needed to overcome this potential limitation to product purity. Sliding seals are more difficult to maintain, provide worse sealing, and are more susceptible to damage due to particle contamination than simple contact seals without sliding. Finally, the rotating valve arrangements make very complex cycles difficult to execute because of the complexity of the rotary valve porting arrangements required for their implementation. These valves have, therefore, chiefly been used to implement simple cycles with relatively low product recovery and adsorbent utilization compared to the most advanced cycles taught in the art.

Please amend paragraph [0024] as follows:

[0024] Figure 1 depicts a three-dimensional, perspective view of the valve manifold 10 of the present invention. The valve manifold 10 is provided with at least one plenum cavity 1, which is in communication with an adsorbent vessel 20 (see Figure 2). The

manifold 10 is further provided with at least one fluid channel 2, which has at least one fluid inlet port 3. The plenum cavity 1 is in communication with fluid channel 2 via internal gallery or fluid passage 4. Note that the manifold ~~can 10~~ <u>10 can</u> include one or more channels 2 that are connected to one or more cavities 1 by one or more passages 4. A variety of different configurations will be readily apparent to one of ordinary skill in the art based upon the teachings set forth herein.

Please amend paragraph [0041] as follows:

[0041] Figures 5a, 5b, and 5c ~~depicts~~ <u>depict</u> an adsorbent vessel 20 having a valve manifold 10 mounted on both ends thereof. Figure 5b depicts an enlarged view of one end of the vessel 20 in which a valve manifold 10 is attached via a pin journal 43 to a rigid linkage 48 and the linkage ~~49~~ <u>48</u> is connected to a supporting structure 47. The pin journal 43 is rotatably connected to the linkage 48 by pin 49a, and the linkage 48 is rotatably connected to the supporting structure 47 by pin ~~49c~~ <u>49b</u>. Figure 5c depicts an enlarged view of the opposite end of the vessel 20 in which a valve manifold 10 is attached via a pin journal 43 directly to the support structure 47. The manifold 10 in Figure 5c is rotatably connected to the supporting structure 47 by pin 49c. Accordingly, the adsorbent vessel 20 depicted in Figures 5a, 5b, and 5c forms an element in a three bar linkage.

Please amend paragraph [0044] as follows:

[0044] Figure 6b depicts an alternative product gas flow control system of the present invention. During the adsorption stage in the improved method the product gas flows

through the inlet 51 and through a non-return valve 56 in parallel with a metering orifice 57. The product then flows through the actuated ~~valve on/off 58~~ <u>on/off valve 58</u> to the product outlet 53. The non-return valve is illustrated in the diagram as a spring-return valve, although any type of non-return valve may be employed. During the counter-current flow step of the cycle, the on-off valve 58 is opened, and the product gas in the product manifold flows from the point 53, through the open on/off valve 58, through the metering orifice 57, into the adsorbent vessel, which is at a lower pressure than the product manifold, through point 51. The non-return valve 56 does not allow reverse flow, so the flowrate of the counterflowing gas may be completely controlled by the metering orifice 57. In the third operational state of this assembly, the on/off valve 58 is closed, and flow between the adsorbent vessels does not occur, irrespective of their relative pressures.

Please amend paragraph [0048] as follows:

[0048] Figure 9 shows another cross-sectional view of the manifold depicted in Figures 7 and 8 including the depiction of the non-return valve of the present invention during the counter-current flow step of the PSA cycle. During this step, the product pressure in the fluid channel 2 is higher than the pressure inside the plenum 1. Thus, there is no pressure force to lift the seal cup 63 off of the seat area 62 against the spring 64. The on/off valve seal 61 is lifted off the seat area by its actuator. A flow metering orifice 65 is provided in the seal cup 63 to allow product flow from the channel 2 to the plenum 1. The flow metering orifice 65 can be formed in the shape of one or more ports as depicted in Figures 7-9, or the flow metering orifice can be constructed by providing clearance between the valve

stem and the seal cup, or by providing gaps, holes or other features at the juncture of the seal cup and the seat area. Any combination of these ~~configuration~~ configurations can also be employed as a flow metering orifice according to the present invention. The especially-preferred embodiment of the non-return valve depicted here has the particular advantage of using only two parts, each of which has a simple shape and can be readily manufactured.

Please amend paragraph [0052] as follows:

[0052] The use of a manifold apparatus of the present invention, which combines flow conduit features and valve porting for more than one vessel, can further reduce overall complexity, volume and mass as compared to other systems. Further, such integral manifolds make valve actuation via mechanical means such as a camshafts or gear trains feasible, thereby further decreasing control system complexity and cost. In the preferred embodiments of the manifold apparatus of the present invention using valves with linear motion between the seal and seat, these advantages are offered while eliminating sliding seals employed in rotary valving systems. The elimination of sliding seals facilitates improved product recovery and purity and increased reliability. Furthermore, if the valves are independently actuated, a PSA system of the present invention may be optimized for varying feed conditions during operation.

Please amend paragraph [0054] as follows:

[0054] The most salient feature of the method and apparatus of the present invention is their broad applicability to almost all PSA systems. Furthermore, both the

apparatus and method may be advantageously applied in PSA systems of any production capacity. The entire disclosure of each of U.S. Provisional App. Ser. No. 60/214,737, filed June 29, 2000, and U.S. Patent App. Ser. Nos. 09/588,575, filed June 7, 2000; 09/642,008, filed August 21, 2000; 09/928,437, filed August 14, 2001; 10/097,745, filed March 15, 2002; and ~~the patent application~~ U.S. Patent App. Ser. No. 10/269,064 entitled HIGH RECOVERY PSA CYCLES AND APPARATUS WITH REDUCED COMPLEXITY by Franklin D. Lomax, Jr. filed ~~currently herewith~~ on October 11, 2002, are incorporated herein by reference in their entirety.